Educational Kit by Singha's Gurukul

ABOUT:

We provide and educational kit based on physics, biology, chemistry and astronomy to make teaching and learning even more convenient, engaging and fun. Instead of focusing on the lectures, our kit leverages digital technology to help the tutor identify, nurture, and inculcate individual skills by making the class more engaging. Enough with the non-imaginative old school way of learning, teaching and knowledge gap, and avoidance of technology. What if we could actually see, touch and play around the experiments, concepts and theories we mug up in a class room?

Singha's Gurukul is a holistic institute that aims to dissolve the mediocrity in educational system and inspire enthusiasm in learning.

2ND PHASE PROJECT PLAN

The 1st phase of the project was successfully completed in which we worked on following projects:

1) Gravitational Force
2) Pascal
3) Hydraulic Press
4) Heat Equation
5) Nervous System
6) DNA
7) Orrery

In the second phase of the project as instructed by Mahabir Pun, we are to proceed by perfecting the 1st phase prototypes and make it more robust and presentable. Along with furthering the remaining of the projects in the syllabus.

The projects we intend to make in the second phase is given below:

1) Gravitational Force
2) Free Fall
3) Hydraulic press
4) Pascal and Archimides
5) Heat Equation
6) Convex lens Ray Diagram Tracing
7) Nervous system
8) Chromosome, Cell Division, DNA
9) Sex Determination
10) Heredity
11) Heart
12) Orrery
13) Dynamo
14) Electromagnetism illustrator

PROJECT DETAIL

1) Gravitational Force: -

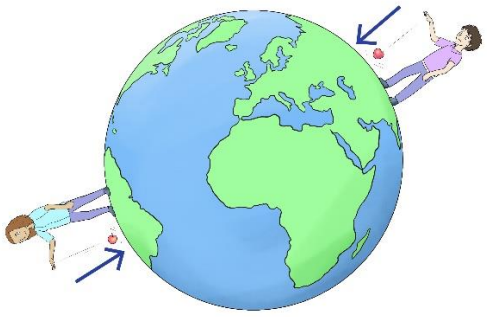
Sensor data:

a) mass

b) distance

Things we'll represent in GUI:

a) Earth, Mass (object of study), and Distance between them.
b) Pictorial representation of gravitational force between different mass at constant distance.
c) Plotting Force relation with changing Mass.
d) Pictorial representation of gravitational force with changing distance but constant mass.



Note: Human replaced by standard masses.

How the experiment will be performed:

Experiment -1 (constant distance, relation of force with mass)

- Set the load platform at certain distance.
- Place .5Kg mass on the load platform, push the button and measure the gravitational force being acted on the mass.
- Plot F-M graph on the GUI.

- Repeat the process by replacing the masses with 1Kg, 1.5Kg, 2Kg and 2.5Kg respectively. At the same time plotting the resultant on GUI.
- Representing the F-M relation on GUI/Dashboard and measuring the slope to show F ∝ M relation.

Experiment – 2 (constant mass, relation of force with distance)

- Place 2.5Kg mass on the load platform and measure the Force keeping the load platform 3cm to the Sun.
- Place the mass 8cm to the earth and measure the force.
- Place the mass at varied distance and measure the force, plot the result on GUI at the same time.
- Repeat the process placing the mass further apart from the Earth and take at least 6 readings and then plot the graph, and its slope.
- Show, F-R relation.

2) Free Fall: -

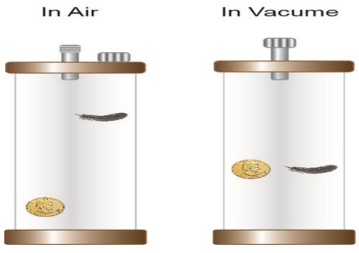
Sensor data: a) time

Things we'll represent in GUI:

a)Pictorial representation of the apparatus.

b)Showing result of the time taken by the object of study to reach the bottom of the apparatus.

.



How the experiment will be performed:

Experiment -1 (Apparatus filled with air)

- Press the button and the objects (one will be magnet and the other will be magnetic feather) will fall.
- Note the time taken by each object of study to reach the bottom.
- Represent the result on the GUI.

Experiment -2 (Vacuum apparatus)

- Press the button and the objects will fall again.
- Note the time taken by each object of study to reach the bottom.
- Represent the result on the GUI.

3) Heat Equation: -

Sensor Data:

a) Mass
b) Temperature

Things we'll represent in GUI:

a) Pictorial representation of the apparatus with real life implication of the subject masses of study.
b) Relation of heat energy with mass and plotting their relation as the experiment proceeds.
c) Relation of heat energy with Specific heat capacity (placing different materials as a subject of study) and plotting the relation as their relation as the experiment proceeds.
d) Relation of heat energy with dt and plotting the relation as the experiment proceeds.
e) Derivation of Q = m*S*dt

How the experiment will be performed:

Experiment -1 (Relation of Q with mass)

- We'll have 3 set of iron with different mass, viz .5Kg, 1Kg, and 1.5Kg.
- Place .5Kg mass on the platform, press the button and then follow the GUI i.e. enter the value of specific heat capacity of the material then enter the value of dt.
- The relay actuates and begins heating the subject mass till the set dt reaches, then the power cuts off and Q is computed and displayed on the screen. While at the same time plotting Q-m result on a graph.
- Repeat the process with different set of masses and trace the plot.
- Draw a slope and show the proportionality relation between heat energy(Q) and mass.

Experiment -2 (Relation of Q with Specific heat capacity)

- Prep 3 set of study materials, viz iron, steel and copper of with same masses.
- Place the iron on the platform, and then follow the GUI as in experiment 1 i.e enter the value of specific heat capacity of the material then enter the value of dt.
- The relay actuates and begins heating the subject mass till the set dt reaches, then the power cuts off and Q is computed and displayed on the screen. While at the same time plotting Q-S result on a graph.
- Repeat the process with different materials, viz steel and copper.
- Draw a slope and show the proportionality relation between heat energy(Q) and Specific heat capacity.

Experiment -3 (Relation of Q with dt)

- This experiment is fairly simple.
- Place .5kg iron on the platform and press the button then follow the GUI as in experiment 1 i.e enter the value of specific heat capacity of the material then enter the value of dt.
- The relay actuates and begins heating the subject mass till the set dt reaches, then the power cuts off and Q is computed and displayed on the screen. While at the same time plotting Q-dt result on a graph.
- Repeat the process on experiment 3 but this time change the value of dt with 1 degree each time and plot the points on the graph.
- Draw a slope and show the proportionality relation between heat energy(Q) and temperature difference(dt).
- Derive Q = m*S*dt at last.

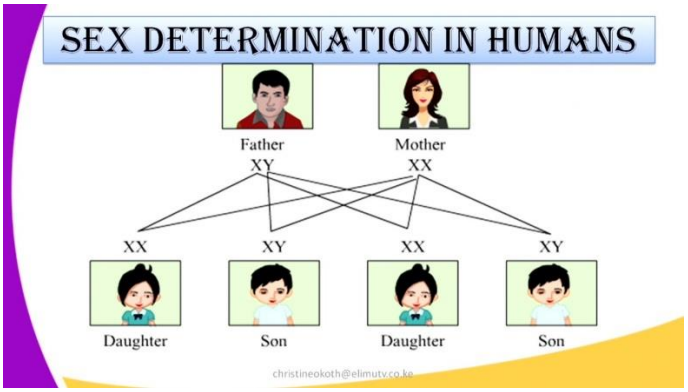
4) **Sex Determination: -**

Sensor Data:

a) 4 Push Button's input.

Things we'll represent in GUI:

a) Picture of a mother and her XX chromosome representation.
b) Picture of a Father and his XY chromosome representation.
c) Possible crossing structure of the chromosome.
d) Picture of baby boy or a baby girl depending on the sensor's data.



How the experiment will be performed:

- The student is free to press any 4 buttons that is representing each sex chromosome from the mother and the father. i.e. Button 1 = X (MOTHER), Button 2 = X (MOTHER), Button 3 = X (FATHER) and Button 4 = Y (FATHER).
- A led will lit up on top of the baby boy's or baby girl's model depending on the input from the student and at the same time displaying the result on GUI as a baby boy's pic or baby girl.
- The student will play around with different buttons and see if baby boy is being let up or the baby girl and the finding is noted down.
- With this the student begins to find the chromosome cross on his own and does not need to rut.

5) Heredity: -

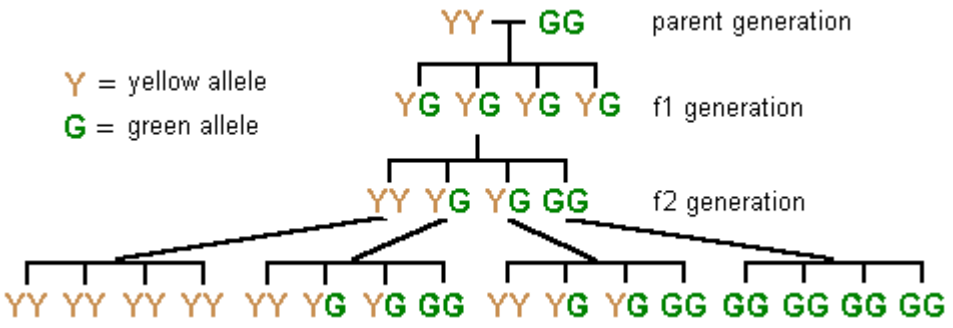
Sensor data:

a) 8 Push button's input.

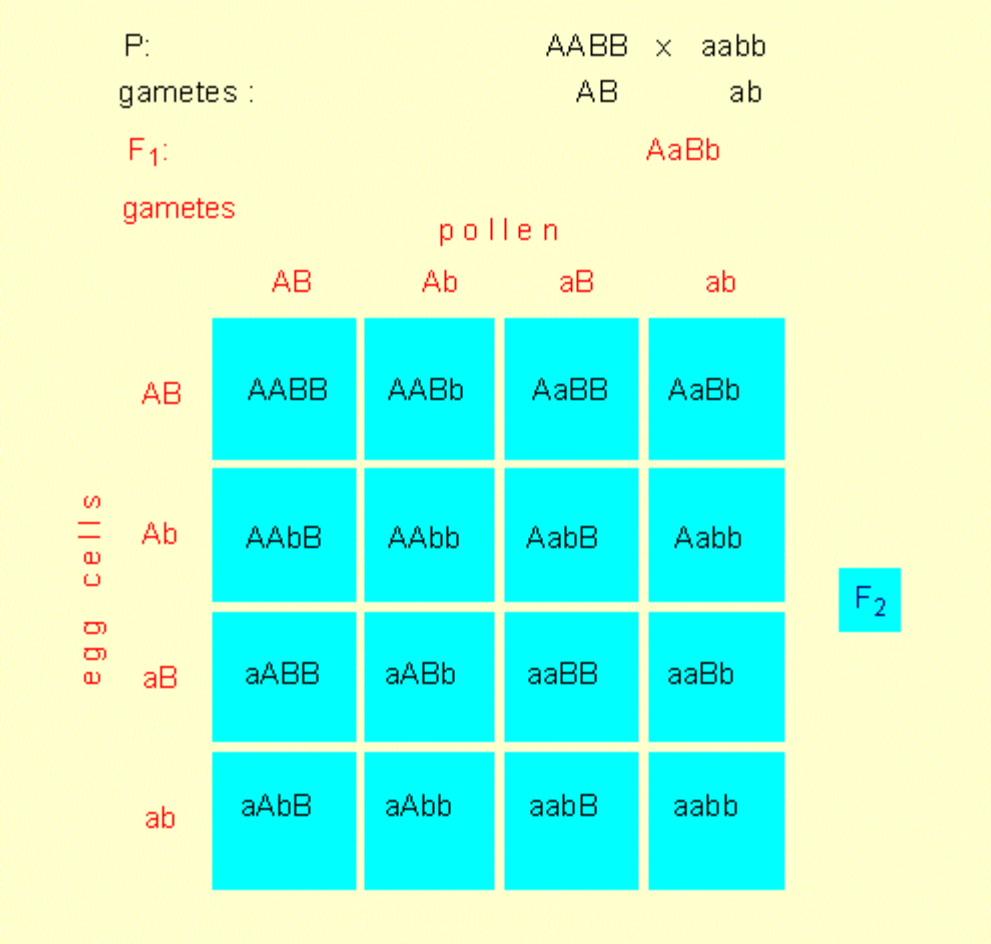
Things we'll represent in GUI:

a) Brown skin and Tall representing B and T respectively all the while fair skin and short representing b and t.

b)



c)



d) These characteristics shall be represented by a brown tall man with gametes (BBTT) and a woman with gametes (bbtt) in the GUI picture.

e) We'll represent the first filial generation(f1) on the screen like that of sex determination.

f) Then we'll work through second filial generation(f2), i.e. in which each parents have BbTt gamete.

g) Press the button representing AB, AB, Ab, Ab, aB, aB, ab, ab and see where the led lits up in the physical model and how it's represented on the GUI.

h) Repeat the process and make a chart like in ©.

i) Study the phenotype and genotype ratio.

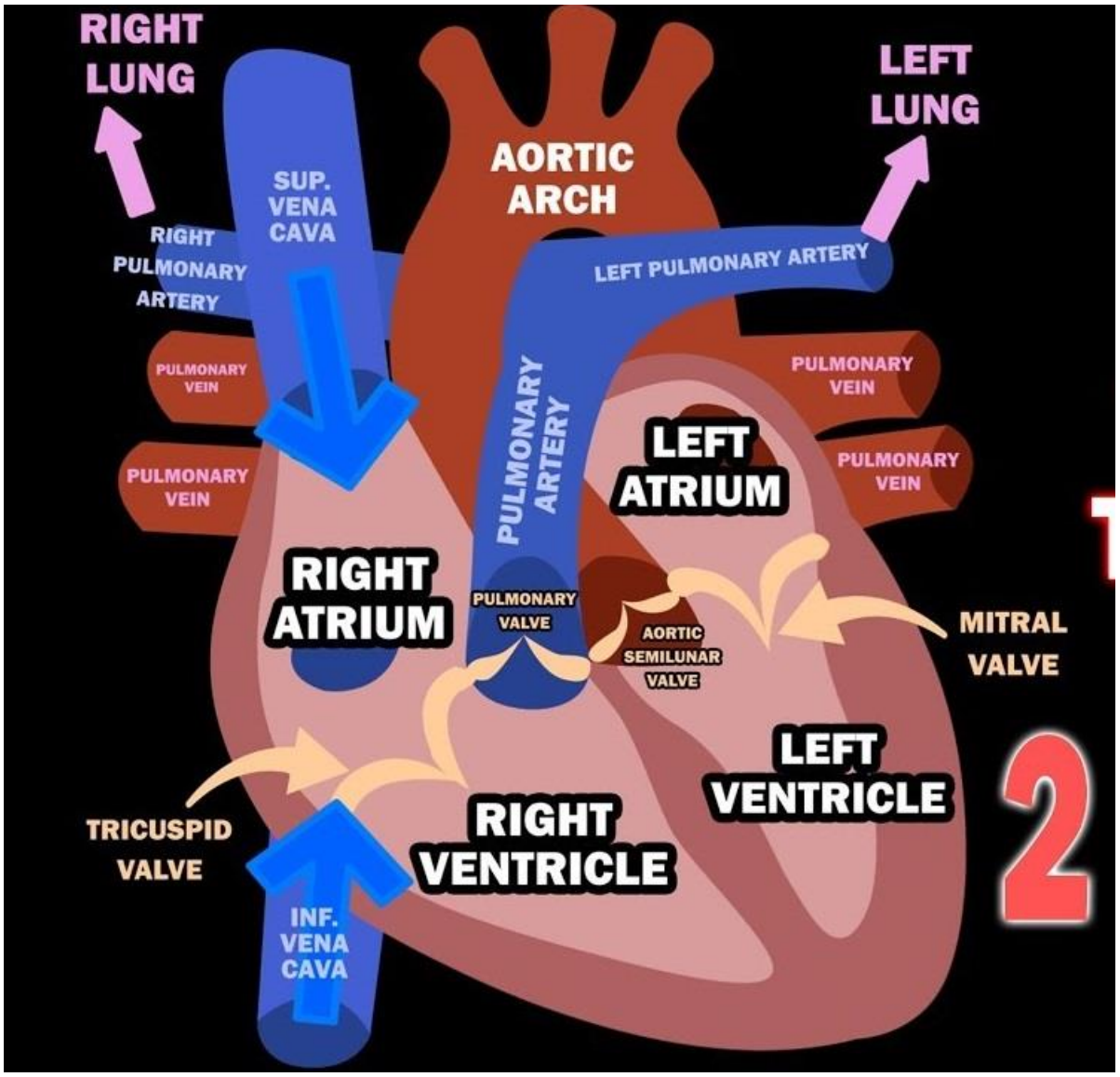
6) Heart: -

Sensor data:

a) Heart rate
b) Systolic and diastolic pressure

Things we'll represent In GUI:

a) Pictorial representation of the heart. i.e.



b) Blood flow happening in the heart model.
c) Displaying the heart rate and systolic and diastolic pressure value on the GUI interface.
d) Plotting the cardiac cycle simultaneously.

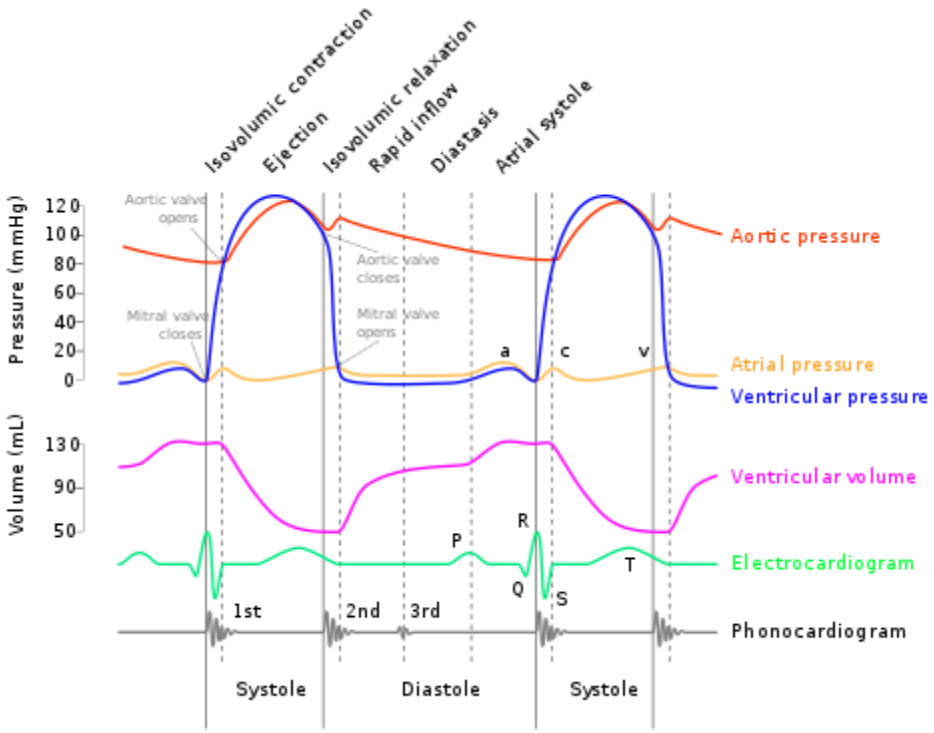


Fig: Cardiac Cycle

How the experiment will be performed:

Just press the button and enjoy the show of hear working.

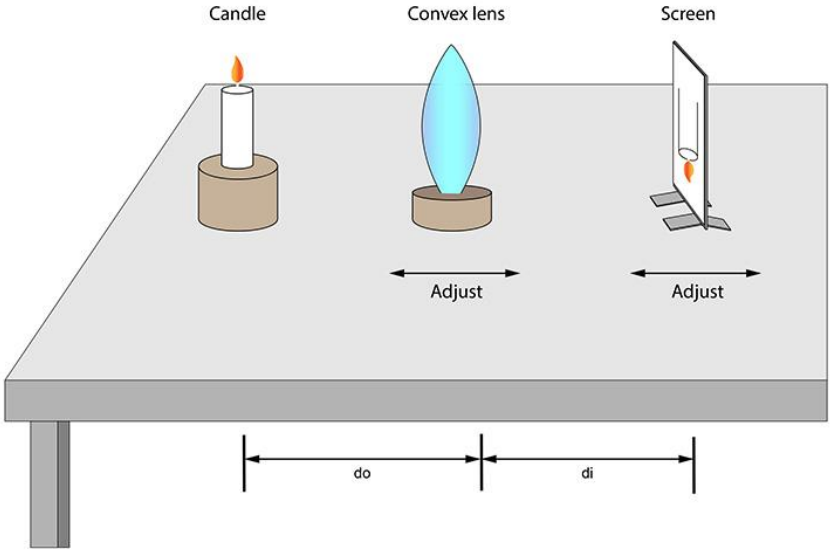
7) Convex lens ray diagram tracing: -

Sensor data:

a) Object and image parameters like object height, object distance, image height and image distance from principal.

Things we'll represent in GUI:

a)



b) We'll change the object and image parameters as the experiment proceeds.

c) Show other parameters of the image, viz. Real/virtual, inverted/erect, magnified/diminished.

How the experiment will be performed:

- Fire up the apparatus.
- Enter the distance from the principal and the object stepper motor will position itself according to the input, enter the distance as 38 first.
- The image stepper motor will actuate automatically till it senses the laser ray.
- The image distance and image height is then automatically calculated and displayed on the screen along with all the parameters.
- Repeat the process at different distance from the principal and observe the image characteristics and parameter values.

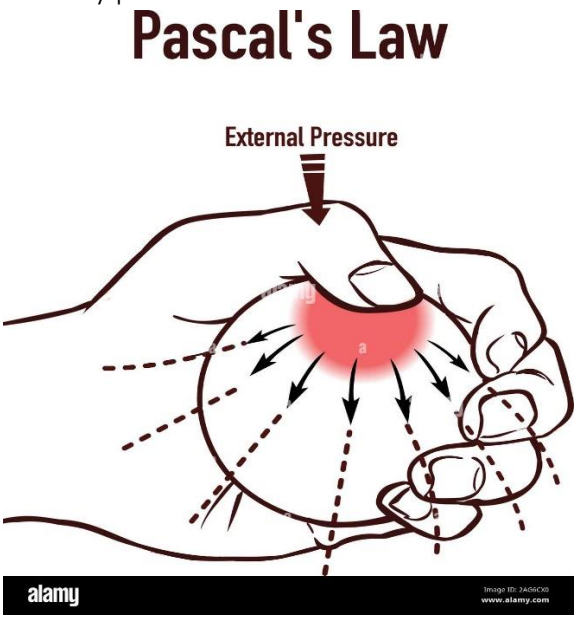
8) Pascal/ Hydraulic/ Archimides

Sensor Data: -

a) Force on the load sensors.

Things we'll represent in GUI:

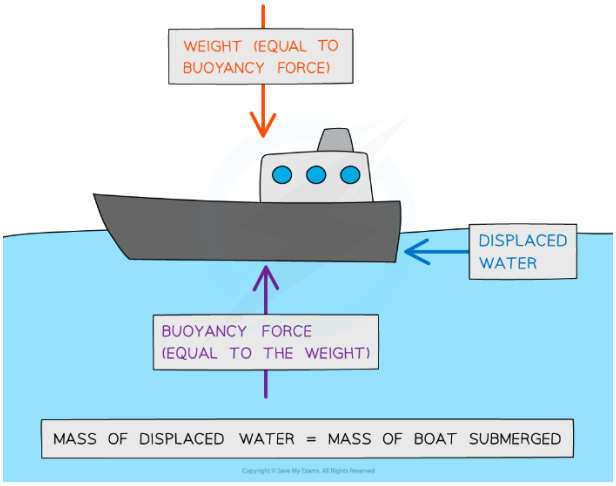
a) Displaying the sensor data on the GUI all the while representation of pascal's law i.e. a pressure change in one part is transmitted without loss to every portion of the fluid.



b) Sensor data and Hydraulic press's real life representation on excavator with the sensor data.

c) Archimide's law of floatation by displaying:
Weight = Buoyant force + Water Displaced
From the senso's data.

And representing each case of law of floatation having different materials of different floating capability. But representing the object as a ship in the GUI.



How the experiment is done:

- Apply load on the master cylinder and see the resultant in each of the slave cylinders.
- Compute hydraulic press by applying pressure on bigger slave cylinder.
- Play around with Archimides model:
  a) Place a non-floating body on the apparatus and the apparatus will compute Weight = Buoyant Force + Water Displaced.
  b) Observe the body's floating condition.
  c) Repeat the process with bodies with equal mass of that of first body but that will partially float and the other that will float and observe the Weight equation.

9) Nervous system (Physical Model, no GUI required)
10) Orrery (Physical Model, no GUI required)
11) Chromosome and DNA (Physical Model, no GUI required)
12) Electricity and Magnetism (Undefined experiment up until now).

BUDGET

Rough estimated cost of the projects that you've made.